

Twenty-first century chemistry has arrived with SSC and the chemical processes it represents: nontoxic supercritical fluid solvents are coupled with a heterogeneous solid catalyst to produce high-quality biodiesel from low- and no-value waste oils.



## Supercritical Solid Catalyst

*Transforming Waste into Fuel and a Better Environment*

In movie theaters in the late '80s, Doc Brown returned from the future in his time-traveling DeLorean, announcing that he'd converted the "flux capacitor" to run on garbage. Researchers at Idaho National Laboratory (INL) have made this fantasy a reality with Supercritical Solid Catalyst (SSC), a process for producing ASTM-quality biodiesel from feedstock sources that have no other market and may actually cost money to dispose of. These sources—brown and black greases and other waste fats, oils, and greases (FOG)—can come from municipal waste water, wastewater scum, industrial food processing, grease traps, and other biological waste streams.

The underlying chemistry of this technology couples the use of non-toxic supercritical fluid solvents with a heterogeneous solid catalyst to achieve a highly efficient, rapid and

robust biodiesel production reaction with the widest range of oils of any biodiesel conversion process. It can handle waste greases with up to 100% free fatty acid (FFA) content, more than 30% water content, and a high level of impurities such as sulfur, phosphorous, calcium and others.

BioFuelBox, Inc., an energy research company, spent 2009 demonstrating the viability of SSC. It constructed a modular, transportable biofuel pilot "microrefinery" that offers commercialization capabilities. These research efforts produced proof that these technological advances can be combined with industrial processes for commercialization at a rate of 3,000 gallons per day. The SSC "microrefinery" has a small footprint (about the size of a couple of semi trailers) and is affordable to municipalities and processing plants. It can be located near food

processing facilities, waste treatment facilities or other waste grease production sites to simplify operations, eliminate waste transportation and reduce waste disposal costs. A tool for improved environmental stewardship and sound business practices, operations incorporating SSC into their processes will turn waste streams into a valuable, vehicle-ready fuel product that can be marketed and distributed locally.

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**R&D 100 Award  
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*The Energy of Innovation*



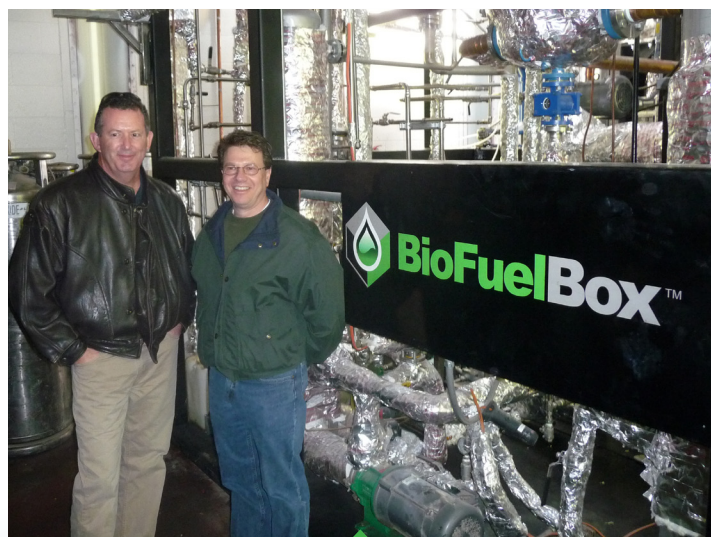
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Together, INL's innovative SSC process and BioFuelBox's refinements earned BioFuelBox's pilot project global recognition by World Economic Forum (WEF) as a Technology Pioneer. In December 2009, WEF noted that the BioFuelBox was among 26 companies offering a disruptive technology that is "developing groundbreaking products and services that can help achieve the promises of sustainable energy." ([www.weforum.org/en/Communities/Technology%20Pioneers/index.htm](http://www.weforum.org/en/Communities/Technology%20Pioneers/index.htm))

### **Benefits the Environment and Human Health While Enhancing Fuel Security**

SSC is the lowest carbon transportation fuel alternative in America today, reducing 60,000 metric tons of CO<sub>2</sub>-equivalent per "microrefinery" per year.

- Greases that normally degrade into CO<sub>2</sub> and methane are converted into an advanced biodiesel that displaces conventional fuels (Note: methane has 21 times the greenhouse gas potency of CO<sub>2</sub>).
- Biodiesel from waste emits even less CO<sub>2</sub> than soy biodiesel. According to the EPA, SSC biodiesel emits 86% less CO<sub>2</sub> than conventional diesel and 78%



*In 2007, INL researchers Bob Fox and Dan Ginosar visited BioFuelBox's demonstration pilot "microrefinery" in American Falls, Idaho, where their breakthrough Supercritical/Solid Catalyst (SSC) process enabled the conversion of food processing waste to ASTM-quality B100 biodiesel.*

less CO<sub>2</sub> than soy biodiesel per gallon.<sup>1</sup>

SSC diverts 10 million pounds of waste from landfills per "microrefinery" per year.

- Converting waste grease into biodiesel not only prevents it from degrading into CO<sub>2</sub> and methane, it also saves space in landfills.
- In turn, the amount of leachate generated by landfills is reduced significantly, which helps protect groundwater and removes an undesirable-smelling contaminant.

SSC produces a significantly cleaner fuel that not only prevents environmental degradation, but is significantly less toxic to people as well.

- Reduced particulate matter and hydrocarbon emissions release far less uncombusted material and toxic gas into the air than petroleum diesel.

- The new B100 fuel burns more completely, reducing unburned hydrocarbons by 67%, carbon monoxide by 48%, and particulate matter by 47%.

An additional benefit of SSC is that it produces fuel from a domestic biomass source without competing with food production or specialized pharmaceutical crops.

#### **For more information**

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<sup>1</sup> U.S. Environmental Protection Agency (EPA) (2010) Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. EPA 420-R-10-006. February 2010.